

REMARKS

The Office Action mailed January 5, 2011, has been received and its contents carefully noted. The pending claims, claims 1, 2 and 5-13, were rejected. By this Response, claims 1 and 13 have been amended. Support may be found in the specification and the claims as originally filed. See, for example, Figures 3 and 4 and the corresponding text of the specification, e.g. paragraphs 0004, 0005, 0021 and 0022. No statutory new matter has been added. Therefore, reconsideration and entry of the claims, as amended, are respectfully requested.

Interview Summary

Applicants appreciate the Examiner taking the time to conduct a telephonic interview on April 13, 2011. During the interview, Applicants proposed the claim amendments submitted herein, and emphasized that, according to the instant invention, the lead-out passage must be of a length that allows sufficient acceleration of the liquid droplets, and that because of this length, the droplets can reconverge. This is the reason for the step-wise transition between the lead-out passage and the injection port which is at the downstream end of the length of the lead-out passage. Applicants pointed out that the cited documents do not teach or suggest that the stage portion 22a of Tachibana be at the downstream end, rather than the upstream end, of a lead-out passage.

Applicants hereby make one further refinement of claims 1 and 13 over what was discussed during the interview. That is, because the claims already defined the injection port as formed (located) at the "front end" of the lead-out passage, we are also reciting that the entrance of the lead-out passage is at the "rear end" thereof. As such, the rear end of the passage is at its upstream most end and the front end of such passage is at its downstream most end.

The Examiner already indicated that he thought the claim amendments, proposed during the interview, and arguments would likely overcome the rejections of record. However, he also stated that further search and consideration would be required. The Examiner also indicated that he would contact the undersigned should additional amendments help place the claims in an allowable condition. Applicants appreciate the Examiner's thoughtful consideration.

Rejection under 35 U.S.C. 103(a)

The Examiner rejected claims 1–2 and 5–13 under 35 U.S.C. 103(a) as being unpatentable over Hirose (US 20030079764) in view of Tateyama (JP 2001252604). This rejection is traversed.

Applicants respectfully submit that the cited documents, alone or in combination, do not teach or suggest the claimed invention. As shown in Applicants' Figures 3 and 4, the gas supply passage and the liquid supply passage open toward an entrance (at the rear end) of the lead-out passage. Paragraph 0021 discloses that the gas and liquid are mixed in the vicinity of the entrance of the lead-out passage 23 to form liquid droplets, and these liquid droplets are lead out via the lead-out passage. As is clear from paragraph 0017 and Figure 3, the injection port is formed at the front end of the lead-out passage. That is, by the injection port 24 formed at the front end of the lead-out passage 23 (see Fig. 3. and Fig. 4), there is achieved an effect such that, as described in paragraph 0022, even when the liquid drops grow along the inner wall of the lead-out passage 23, while passing through the lead-out passage 23, they are atomized again while passing through the injection port 24. As described in paragraphs 0004 to 0005, when there is a large dispersion in particle diameters of injected liquid drops, large liquid drops may be injected to the surface of a wafer and damage the surface of the wafer. Also, when there is a dispersion in injection speeds another problem occurs in that slow liquid drops may decrease the cleaning effect. The present invention avoids these problems by the specified configuration of the lead-out passage and the step-wise transition as set forth in the claims, which ensure sufficient acceleration of droplets that are sufficiently atomized. See 0025 of the instant specification.

Hirose discloses a two-fluid nozzle for cleaning, but the "passage 45a" has a constant cross-sectional area (Fig. 7) from the rear or upper end, where N_2 and water are mixed, to the opening at the front or lower end. In paragraph 0078 of Hirose, there is no description about the shape of the injection port at the front or lower end, or its cross-sectional area. When the cross-sectional area of the passage is constant as shown in Fig. 7, liquid drops grow along the inner wall and simply pass through the lead-out passage unhindered as described in paragraph 0022 of Applicants' specification.

As set forth in claim 1 by contrast, the present invention requires a transition between the lead-out passage and the injection port that is step-wise, with a cross-sectional area S_b (see Applicants' Fig. 4) of the injection port 24 smaller than a cross-sectional area S_a of the lead-out passage 23. Thus, liquid drops which have grown are re-atomized by the interior wall of the injection port. Nowhere does Hirose teach or suggest such a structure or effect, as instantly claimed.

Tachibana does not alleviate the deficiencies of Hirose. According to Tachibana, a "staged portion 22a" is provided for mixing condensed syrup with carbonated water or cold water. However, the staged portion 22a clearly is taught to those of ordinary skill in the art or provided at the front (upstream) end of the lead-out passage in which a mixed beverage flows, not the rear or downstream end.

On the other hand, according to the instant invention as claimed, gas and liquid are mixed in the rear end portion of the lead-out passage, whereafter liquid drops formed therein pass through the lead-out passage, and arrive at the injection port provided at the front end portion of the lead-out passage. By this injection port, even if the liquid drops have grown while moving along the inner wall of the lead-out passage, the liquid drops are re-atomized as they pass through the injection port to make the drop of essentially uniform diameter and speed. As described in Applicants' paragraph 0044 and Figure 4, since large liquid drops divide into plural liquid drops in the injection port, the number of liquid drops increases, so that a large number of fine-particle liquid drops can be injected at a favorable injection speed to the wafer.

As described above, the staged portion of Tachibana is different from that in the present invention, as claimed, and those of ordinary skill in the art would not have achieved atomization like Applicants' with the injection port having the staged portion of Tachibana. Therefore, even if Hirose were to be combined with Tachibana, the combination does not result in the claimed invention as a whole, i.e. re-atomizing liquid drops before injection.

Therefore, Applicants respectfully submit that the claims, as amended, are unobvious and that the rejection under 35 U.S.C. 103(a) should be withdrawn.

Request for Interview

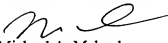
A telephonic or an in-person interview is respectfully requested should there be any remaining issues.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Therefore, it is respectfully requested that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Official action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

It is not believed that extensions of time are required, beyond those that may otherwise be provided for in accompanying documents. However, in the event that additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. 1.136(a), and any fees required therefor are hereby authorized to be charged to **Deposit Account No. 02-4300, Attorney Docket No. 033082M341.**

Respectfully submitted,
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